Studies on Quantum Information

Objective

To obtain new insights in the growing field of quantum information

Summary of Research Activities

- There is growing interest in quantum information. Our results provide new insights into the following problems: quantum state tomography of large nuclear spins in a semiconductor quantum well, generating nonclassical photon states via longitudinal couplings between superconducting qubits and microwave fields, Statistical mixtures of states can be more quantum than their superpositions, bistable photon emission from a solid-state single-atom laser, certifying single-system steering for quantum-information processing, Increasing relative nonclassicality quantified by standard entanglement potentials by dissipation and unbalanced beam splitting, multiphoton quantum Rabi oscillations in ultrastrong cavity QED, entangling superconducting qubits in a multi-cavity system, and quantifying non-Markovianity with temporal steering.

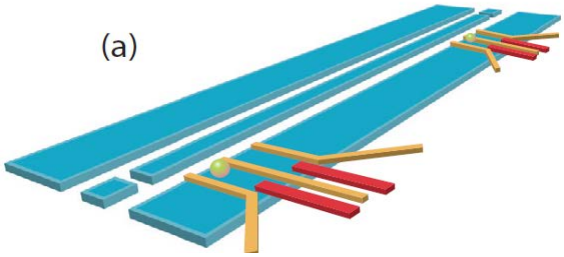

Fig. 1: Photon-mediated electron transport between two quantum dots in a (coplanar waveguide) cavity.

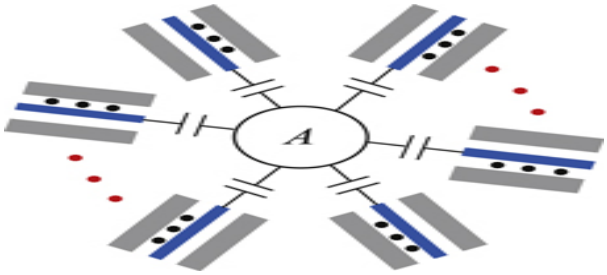

Fig.2 Diagram of a coupler qubit A (circle at the center) and N cavities each hosting qubits. Each cavity here is a 1D coplanar waveguide transmission line resonator.

Publications

A. Miranowicz, Ş.K. Özdemir, J. Bajer, G. Yusa, N. Imoto, Y. Hirayama, F. Nori, *Quantum state tomography of large nuclear spins in a semiconductor quantum well: Optimal robustness against errors as quantified by condition numbers*, Phys. Rev. B 92, 075312 (2015).

Y.J. Zhao, Y.L. Liu, Y.X. Liu, F. Nori, *Generating nonclassical photon states via longitudinal couplings between superconducting qubits and microwave fields*, Phys. Rev. A 91, 053820 (2015).

A. Miranowicz, K. Bartkiewicz, A. Pathak, J. Peřina Jr., Y.N. Chen, F. Nori, *Statistical mixtures of states can be more quantum than their superpositions: Comparison of nonclassicality measures for single-qu*

N. Lambert, F. Nori, C. Flindt, *Bistable Photon Emission from a Solid-*

C.M. Li, Y.N. Chen, N. Lambert, C.Y. Chiu, F. Nori, *Certifying single*

92, 062310 (2015).

A. Miranowicz, K. Bartkiewicz, N. Lambert, Y.N. Chen, F. Nori, *Increasing relative nonclassicality quantified by standard entanglement potentials by dissipation and unbalanced beam splitting*, Phys. Rev. A 92, 062314 (2015).

L. Garziano, R. Stassi, V. Macrì, A.F. Kockum, S. Savasta, F. Nori, *Multiphoton quantum Rabi oscillations in ultrastrong cavity QED*, Phys. Rev. A 92, 063830 (2015).

C.P. Yang, Q.P. Su, S.B. Zheng, F. Nori, *Entangling superconducting qubits in a multi-cavity system*, New J. Phys. 18, 013025 (2016).

S.L. Chen, N. Lambert, C.M. Li, A. Miranowicz, Y.N. Chen, F. Nori, *Quantifying Non-Markovianity with Temporal Steering*, Phys. Rev. Lett. 116, 020503 (2016).